PROSTHETIC PIN LOCKING MECHANISM WITH VACUUM TUNNELS

FIELD OF ART

The disclosure relates to the field of prosthetic devices, and more particularly to a prosthetic device, system and method for increasing vacuum in a vacuum assisted suspension system.

BACKGROUND

With advancements in prosthetic components, improved suspension solutions have become a pressing need. Elevated vacuum suspension has been around for nearly a decade, and improves proprioception and volume control. The concept is well accepted and has gained many users.

A vacuum in the sense of elevated vacuum solutions refers to creating pressure significantly lower than atmospheric pressure. In prosthetic systems, a vacuum is not applied directly to the skin, but typically between the hard socket and the skin interface. The vacuum system is adapted to stabilize soft tissue volume at the residuum that the liner and hard socket surround and maintain more effective suspension of a prosthetic system.

A significant drawback to known elevated vacuum solutions is they fail to adapt to limb volume change which occurs particularly when a user is walking. Yet another drawback is that in some cases a vacuum formed at the bottom of a tight socket can suck a residual limb into the socket during donning causing various skin and soft tissue problems with the limb.

Accordingly, there is a need for a prosthetic device, system and method that provides an elevated vacuum solution that adapts to a residual limb during normal use. There is also a call to provide an elevated vacuum solution that does not present a danger of sucking a residual limb into the socket during donning. There is a demand for safely applying a vacuum where it is needed, while still stabilizing volume and maintaining vacuum suspension.

SUMMARY

In an embodiment of a pin lock for a prosthetic device in a vacuum assisted suspension system, the pin lock includes a pin defining a longitudinally elongate bore and at least one passageway extending obliquely relative to the bore and communicating therewith at a proximal end of the pin. The pin lock also includes a locking mechanism having a receiving port arranged to receive the pin and a channel located at a distal end of the receiving port and adapted to communicate with the bore to exhaust air through the pin therefrom.

The pin may define an annular flange protruding from a proximal area and a shaft extending distally from the annular flange. The bore is formed concentric with the shaft. The annular flange may be arranged to rest against the locking mechanism when the shaft is fully received by the receiving port. The annular flange may be located proximally to the at least one passageway. The receiving port may define a conical opening narrowing distally toward an elongate cavity adapted to closely receive shaft. The annular flange may have an edge profile adapted to correspondingly mate with a surface of the receiving port defining the conical opening.

The receiving port may define an elongate cavity adapted to closely receive the shaft. The locking mechanism may include a first seal protruding inwardly into the cavity from a side wall defining the cavity and adapted to engage an outer surface of the shaft. A second seal protrudes inwardly into the cavity from the side wall and is adapted to engage the outer surface of the shaft. The second seal is located proximally to the first seal and spaced a distance apart from the first seal.

The locking mechanism may form at least one release port located along the cavity and communicate to exterior of the locking mechanism to expel air therefrom. The at least one release port may extend generally perpendicularly to a longitudinal length of the cavity. The receiving port may define an elongate cavity adapted to closely receive the shaft. The first is adapted to engage an outer surface of the shaft and is located distally to the at least one release port. The second seal may be located proximally to the first seal and spaced a distance apart from the first seal and at least one release port.

The at least one passageway may generally extend perpendicular to the bore. An outer surface of the shaft may be substantially smooth.

Alternative means may be provided to prevent withdrawal of the pin from the locking mechanism, and such means may include a rack and pinion device or a ratchet device, whereby both the pin and locking mechanism have features permitting selective engagement with one another.

A method for expelling air in a prosthetic device with a vacuum assisted suspension system includes providing the prosthetic device with a suspension liner carrying a pin at a distal end and a socket. The suspension liner is placed into the socket and the pin is oriented with the receiving port. The pin is inserted into the receiving port such that air between the socket and the suspension liner is expelled at least through the passageway into the bore and through the channel to an exterior of the locking mechanism.

The method may further include resting the annular flange at a proximal area above the at least one passageway against a proximal end of the locking mechanism when the pin is fully received by the receiving port. An outer surface of the pin may be sealed against the side wall defining the cavity of the receiving port. First and second seals may protruding inwardly into the cavity and engage the outer surface of the shaft. Air may be expelled from a side wall via the at least one port as the pin is inserted into the cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

The prosthetic device is described referring to the accompanying drawings which show preferred embodiments according to the device described. The device, system and method as disclosed in the accompanying drawings are illustrated for example only. The elements and combinations of elements described below and illustrated in the drawings can be arranged and organized differently to result in embodiments still within the spirit and scope of the device described.

FIG. **1** shows a front view of an embodiment of the prosthetic device.

FIG. **2** shows another front view of an embodiment of the prosthetic device.

FIG. **3** shows an embodiment of the pin locking mechanism.

FIG. **4** shows an embodiment of the plunger being inserted into a locking mechanism.

FIG. **5** shows the plunger completely inserted into the locking mechanism.

FIGS. **6**A-**6**C show another embodiment of the prosthetic device and installation thereof

FIGS. **7**A-**7**C show another embodiment of the prosthetic device and installation thereof.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

A better understanding of different embodiments of the prosthetic device may be gained from the following descrip-